

## Complete Summary

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### GUIDELINE TITLE

ACR Appropriateness Criteria™ for radiologic investigation of patients with hematuria.

### BIBLIOGRAPHIC SOURCE(S)

American College of Radiology (ACR), Expert Panel on Urologic Imaging. Radiologic investigation of patients with hematuria. Reston (VA): American College of Radiology (ACR); 2001. 5 p. (ACR appropriateness criteria). [22 references]

### GUIDELINE STATUS

This is the current release of the guideline. It updates a previous version: Newhouse JH, Amis ES, Bigongiari LR, Bluth EI, Bush WH, Choyke PL, Fritzsche P, Holder L, Sandler CM, Segal AJ, Resnick MI, Rutsky EA. Radiologic investigation of patients with hematuria. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun; 215(Suppl):687-91.

All Appropriateness Criteria™ topics are reviewed annually and updated as appropriate.

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## SCOPE

### DISEASE/CONDITION(S)

Hematuria

### GUIDELINE CATEGORY

Evaluation  
Screening

#### CLINICAL SPECIALTY

Family Practice  
Internal Medicine  
Nephrology  
Radiology  
Urology

#### INTENDED USERS

Health Plans  
Hospitals  
Managed Care Organizations  
Physicians  
Utilization Management

#### GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of radiologic examinations in the investigation of patients with hematuria

Note: This guideline is limited to adults and does not refer to patients whose hematuria coexists with other clinical situations reviewed in other criteria, including acute trauma, infection, renal failure, symptoms of acute stone disease, known renal masses, and prostatism. It is also limited to initial tests; follow-up in cases of normal or abnormal first tests is beyond its scope.

#### TARGET POPULATION

Adult patients with hematuria

#### INTERVENTIONS AND PRACTICES CONSIDERED

1. Excretory urography (intravenous pyelogram [IVP])
2. Transabdominal ultrasound of kidney and bladder
3. Computed tomography (CT) urography
4. Magnetic resonance (MR) urography
5. Computed tomography abdomen/pelvis
6. Renal angiography
7. Plain abdominal film (kidneys, ureters, bladder [KUB])
8. Body coil magnetic resonance imaging (MRI) of abdomen and pelvis
9. Urinary tract scintigraphy
10. Chest x-ray

#### MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in investigation of patients with hematuria

## METHODOLOGY

### METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

### DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

### NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

### METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

### RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

### METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

### DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

### METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

### DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed

by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible.

#### RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

#### COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

#### METHOD OF GUIDELINE VALIDATION

Internal Peer Review

#### DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

### RECOMMENDATIONS

#### MAJOR RECOMMENDATIONS

Clinical Condition: Hematuria

Variant 1: All patients except those with generalized renal parenchymal disease or young females with hemorrhagic cystitis.

Radiologic Exam Procedure	Appropriateness Rating	Comments
IVP	8	
Transabdominal US of kidney and bladder	6	May miss ureteral and urothelial lesions; abdomen x-ray, retrograde pyelography, and cystoscopy are useful adjuncts.
CT urography	6	Preliminary data promising. Active

Radiologic Exam Procedure	Appropriateness Rating	Comments
		investigation ongoing.
MR urography	4	
CT abdomen/pelvis	4	CT may follow IVP or US if initial findings are ambiguous.
Renal angiography	4	Rarely, vascular malformations may cause hematuria and require angiography for diagnosis.
KUB	2	It is assumed that an abdomen film will be part of the indicated IVP. If an IVP is not performed, KUB may be performed along with US.
Body coil MRI of abdomen and pelvis	2	
Urinary tract scintigraphy	2	
<p>Appropriateness Criteria Scale  1 2 3 4 5 6 7 8 9  1=Least appropriate 9=Most appropriate</p>		

Abbreviations: IVP, excretory urography/intravenous pyelogram; US, ultrasound; CT, computed tomography; MR, magnetic resonance; KUB, plain abdominal film (kidneys, ureters, bladder); MRI, magnetic resonance imaging

Variant 2: Due to generalized renal parenchymal disease.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Transabdominal US of kidney and bladder	8	For renal volume and morphology and as localizer for biopsy.
Chest x-ray	6	For cardiopulmonary and pleural manifestations of renal diseases.
CT abdomen/pelvis	2	
Renal angiography	2	
Body coil MRI of abdomen and pelvis	2	
Urinary tract scintigraphy	2	

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT urography	2	
MR urography	2	
KUB	1	
IVP	1	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Variant 3: Hemorrhagic cystitis in females less than 40 years old (hematuria completely clears with therapy).

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT abdomen/pelvis	2	This and other imaging are rarely needed for diagnosis.
Urinary tract scintigraphy	2	
Body coil MRI abdomen and pelvis	2	
Renal angiography	2	
CT urography	2	
MR urography	2	
IVP	1	
KUB	1	
Transabdominal US of kidney and bladder	1	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging; MR, magnetic resonance; IVP, excretory urography/intravenous pyelogram; KUB, plain abdominal film (kidneys, ureters, bladder); US, ultrasound

Hematuria is one of the most common presentations of patients with urinary tract diseases and of patients referred for urinary imaging. This review will summarize

practice for the radiologic approach to such patients. It is limited to adults and does not refer to patients whose hematuria coexists with other clinical situations reviewed in other criteria, including acute trauma, infection, renal failure, symptoms of acute stone disease, known renal masses, and prostatism. It is also limited to initial tests; follow-up in cases of normal or abnormal first tests is beyond its scope.

The initial decision to be made is whether all patients with any degree of hematuria need imaging evaluation. Patients whose urinary tracts have no detectable abnormalities normally release small amounts of blood into the urine, so that several red cells per high-power field may be seen upon microscopic examination of the spun sediment. This fact, together with the low prevalence of clinically detectable disease in some groups of patients with asymptomatic microscopic hematuria, has led some investigators to suggest that minimal microhematuria in an asymptomatic young adult needs no evaluation. Unfortunately, no threshold number of red blood cells per high-power field has been found that separates patients with clinically important disease from those with no detectable urinary tract abnormalities. The distinction between gross and microscopic hematuria is not a useful guideline to distinguish between patients who need evaluation and those who do not, and the ranges of red cells per high-power field in patients with "normal" hematuria and those in whom microhematuria indicates important or even life-threatening disease have sufficient overlap that many authorities claim that any amount of hematuria, no matter how slight, should be considered an indication of urinary tract malignancy until proven otherwise, and that all cases of hematuria therefore need complete work-up.

Given this range of opinions, it would certainly be imprudent to fail to work up a patient with hematuria simply because of the patient's relatively young age or relatively small amount of blood. There may, however, be specific circumstances in which complete radiologic work-up is not necessary. Young women with a clinical picture of simple cystitis, whose hematuria completely and permanently resolves after successful therapy, can probably be spared any imaging. Patients who have clear-cut evidence of glomerulopathy also constitute a special group; although they should probably have chest radiography to search for any of the numerous manifestations of glomerulonephritis (including cardiac enlargement, pleural and pericardial effusions, pulmonary congestion and edema, and pulmonary bleeding) and ultrasound (to display the site and number of kidneys prior to biopsy and to screen for renal morphologic abnormalities that may coexist by chance in a patient with glomerulonephritis), they probably do not need extensive work-up to exclude a surgical lesion that may be bleeding. However, the decision to pursue this course requires firm demonstration that the glomerular abnormality is responsible for the bleeding; such evidence includes heavy proteinuria (sufficient to indicate that plasma proteins, rather than proteins in red cells, account for the protein in the urine), red cell casts, or (in institutions that have reliable traditions of identifying such abnormalities) evidence of severe red cell dysmorphism. Patients on anticoagulants have a sufficiently high prevalence of important disease that work-up cannot be forgone.

All other adult patients, especially those specifically referred for evaluation of hematuria, require imaging evaluation. This evaluation will almost always be accompanied by cystoscopy, since many bleeding urinary tract lesions arise in the

lower tract and no imaging procedure is highly sensitive in diagnosing most of them. It goes without saying that a complete history, physical examination, urine analysis, and appropriate serologic tests should precede or accompany the imaging examinations.

There is not universal agreement with regard to the first imaging examination to choose. Traditionally, the excretory urography (intravenous pyelogram [IVP]) was standard, but the establishment of this practice preceded the development of high-quality ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). Subsequently, real-time ultrasound was investigated and found to be useful in the search for bleeding urinary tract lesions. Very recently, the combination of urinary tract CT with various ways of obtaining IVP-like images of the collecting systems, ureters, and bladder have been proposed as have similar formats of magnetic resonance imaging examinations (CT urography and magnetic resonance [MR] urography). Urinary tract scintigraphy possesses insufficient spatial resolution to screen for any but large intrarenal or obstructing lesions.

There is some literature dealing with the choice between ultrasound and excretory urography as the initial imaging study for patients with hematuria. With respect to the wide range of abnormalities that may be encountered in such patients (including urinary tract neoplasms of all sorts, stone disease, inflammatory processes, congenital abnormalities, vascular lesions, and obstruction from a wide variety of lesions), both exams are felt to have moderately high sensitivity. Precise comparisons of the two are lacking for several reasons: false-negative rates have not been evaluated in large numbers of patients due to the cost and invasiveness of the follow-up procedures that would be necessary; sensitivities need to be individually evaluated for each of the many kinds of lesions, so that a careful comparative study would require thousands of patients for appropriate statistical power; and there has been little careful definition of the patient groups in whom the two modalities have been compared. Nevertheless, it appears that there are only slight differences between the two modalities with regard to the rate of diagnosing clinically important lesions. Ultrasound and urography tend to miss different sorts of lesions. Ultrasound is not likely to detect nonobstructing ureteral stones or small urothelial abnormalities, and urography with nephrotomography may miss small exophytic anterior and posterior renal masses and small bladder lesions. The choice of exam may be affected by clinical circumstances (a positive urinary cytologic analysis may make urography crucial, whereas serious risk factors for contrast reactions may make ultrasound more appropriate). When ultrasound is negative and the source of hematuria remains obscure, urography should be added; if urography is negative, CT (or ultrasound) may be ordered. When ultrasound is used as the primary screening modality, the yield from imaging may be increased by adding a plain film of the abdomen.

CT of the entire urinary tract can be augmented by images of the contrast-opacified collecting systems, ureters and bladder; the combined exam is known as CT urography. The IVP-like portions of the exam may be obtained by exposing film (or direct digital) images when contrast administered for the CT has opacified the hollow urinary organs. Images may alternatively be produced by reformatting delayed CT images to show this anatomy. Presumably, the pyelogram portion of this exam could be comparable to a standard IVP exam, and the CT should be more sensitive and specific (both statistically and pathologically) than ultrasound

or nephrotomography with regard to focal renal parenchymal abnormalities. For these reasons, CT urography is being employed with increasing frequency, even though ongoing experimental demonstration of its efficacy is incomplete.

Magnetic resonance urography has the potential to be useful in the search for important abnormalities that cause hematuria. Initial work demonstrating the feasibility of its performance has been published. But the examination has not been adopted in clinical practice, is expensive, and has not been evaluated for efficacy, so it cannot be recommended as an initial examination.

In summary, most adults with hematuria of any degree require urinary tract imaging. Glomerulopathies may be appropriately investigated with renal ultrasound and chest radiography; most other patients require urography, CT urography or ultrasound; and a few carefully chosen patients may need no imaging at all.

#### CLINICAL ALGORITHM(S)

None provided

### EVIDENCE SUPPORTING THE RECOMMENDATIONS

#### TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

### BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

#### POTENTIAL BENEFITS

Appropriate evaluation of radiologic exam procedures for patients with hematuria

#### POTENTIAL HARMS

- Ultrasound is not likely to detect nonobstructing ureteral stones or small urothelial abnormalities
- Urography with nephrotomography may miss small exophytic anterior and posterior renal masses and small bladder lesions.

### QUALIFYING STATEMENTS

#### QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment.

Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other coexistent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

## IMPLEMENTATION OF THE GUIDELINE

### DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

## INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

### IOM CARE NEED

Getting Better

### IOM DOMAIN

Effectiveness

## IDENTIFYING INFORMATION AND AVAILABILITY

### BIBLIOGRAPHIC SOURCE(S)

American College of Radiology (ACR), Expert Panel on Urologic Imaging. Radiologic investigation of patients with hematuria. Reston (VA): American College of Radiology (ACR); 2001. 5 p. (ACR appropriateness criteria). [22 references]

### ADAPTATION

Not applicable: The guideline was not adapted from another source.

### DATE RELEASED

1995 (revised 2001)

### GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

#### SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™.

#### GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Urologic Imaging

#### COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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#### FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

#### GUIDELINE STATUS

This is the current release of the guideline. It updates a previous version: Newhouse JH, Amis ES, Bigongiari LR, Bluth EI, Bush WH, Choyke PL, Fritzsche P, Holder L, Sandler CM, Segal AJ, Resnick MI, Rutsky EA. Radiologic investigation of patients with hematuria. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun; 215(Suppl): 687-91.

All Appropriateness Criteria™ topics are reviewed annually and updated as appropriate.

#### GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the [American College of Radiology \(ACR\) Web site](#).

Portable Digital Assistant (PDA): ACR Appropriateness Criteria™ - Anytime, Anywhere (PDA version) is available from the [ACR Web site](#).

Print copies: Available from the American College of Radiology, Department of Quality & Safety, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- American College of Radiology ACR Appropriateness Criteria™ introduction. Reston (VA): American College of Radiology; 6 p. Available in Portable Document Format (PDF) from the [ACR Web site](#).

## PATIENT RESOURCES

None available

## NGC STATUS

This summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI on September 7, 2004. The updated information was verified by the guideline developer on October 8, 2004.

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Date Modified: 2/28/2005

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